

SUPPORT FOR THE AMENDMENTS

Support for the amendment of Claim 1 is found in Claim 6 and on page 12, lines 14-16 and 21-25, and page 17, line 23 and bridging to page 18, in the specification.

Claim 1 is amended to recite alkali metal, not alkaline metal. This amendment corrects an obvious error, as the specification describes potassium and sodium as alkaline metals (page 12, lines 8-10). One of ordinary skill in the art recognizes these metals as alkali metals.

Claim 16 is new and is supported by Claim 1 as herein amended and supported above.

No new matter will be added to this application by entry of this amendment.

Upon entry of this amendment, Claims 1-4 and 7-16 are active. Claim 5 was previously canceled.

REMARKS/ARGUMENTS

The claimed invention is directed to a method to produce a hydrocarbon-containing gas of low sulfur compound content and production of a low sulfur content hydrogen as a fuel for a fuel cell. The claimed invention provides a method for removing sulfur compounds contained in a hydrocarbon-containing gas comprising feeding a hydrocarbon-containing gas to a desulfurizing bed to remove sulfur compounds contained in the hydrocarbon-containing gas, wherein the desulfurizing bed comprises two desulfurizing agents. Desulfurizing agent A comprises zeolite and at least one metal component selected from the group consisting of Ag, Cu, Ni, Zn, Mn, Fe, Co, an alkali metal, an alkaline earth metal and a rare earth metal. Desulfurizing agent B comprises at least one selected from the group consisting of cerium oxide and a metal component-carried on a porous inorganic oxide, wherein the metal component is at least one selected from the group consisting of Ag, Cu, Ni, Fe, Co, Si, an alkali metal, an alkaline earth metal and a rare earth metal, and the porous inorganic oxide is

at least one selected from the group consisting of alumina, silica-alumina and cerium oxide.
No such method is disclosed or suggested in the cited references.

Applicants respectfully note that Claim 1 is herein amended to include the description of desulfurizing agent B as comprising at least one selected from the group consisting of cerium oxide and a metal component carried on a porous inorganic oxide, wherein the metal component is at least one selected from the group consisting of Ag, Cu, Ni, Fe, Co, Si, an alkali metal, an alkaline earth metal and a rare earth metal, and the porous inorganic oxide is at least one selected from the group consisting of alumina, silica-alumina and cerium oxide.

The rejection of Claims 1-4 and 6-15 under 35 U.S.C. 103(a) over Takashi et al. (JP 2001-278602) in view of Satokawa et al. (U.S. 2001/0014304) is respectfully traversed.

The combination of Takashi and Satokawa neither discloses nor suggests the method of desulfurization of hydrocarbon-containing gas as presently described in Claim 1 and claims dependent thereon of the claimed invention.

Takashi is directed to a method for removing sulfur contaminants from petroleum hydrocarbons, specifically benzothiophene or dibenzo thiophenes. The reference describes the difficulty in the removal of these materials and indicates that after much research a process involving contacting the petroleum hydrocarbon with a first desulfurization agent which is a **halogen supported on a porous substrate** [0005] and [0007] (17th group element, preferably Bromine) and a second desulfurization agent such as Co-Mo/alumina and Ni-Mo/alumina [0010] was developed.

The Examiner has acknowledged that Takashi does not disclose using a desulfurizing agent comprising zeolite and at least one metal component selected from the group consisting of Ag, Cu, Ni, Zn, Mn, Fe, Co, an alkali metal, an alkaline earth metal and a rare earth metal and has cited Satokawa to show metals on a zeolite support.

Satokawa is directed to an adsorbent for removing sulfur compounds from fuel gases containing sulfur compounds, which comprises one or more transition metals ion-exchanged

onto a zeolite resin and a method for removing sulfur compounds by passing the fuel-gas through the adsorbent. The sulfur compounds are described in [0005] as:

“ . . . such as a sulfide, a thiophene, or a mercaptan, for use as an odorant for the purpose of security against the leakage thereof. More particularly, sulfides include dimethyl sulfide . . . , ethylmethyl sulfide, diethyl sulfide and the like, thiophenes include tetrahydrothiophene . . . , and mercaptans include t-butyl mercaptan . . . , isopropyl mercaptan, n-propyl mercaptan, t-amyl mercaptan, t-heptyl mercaptan, methyl mercaptan, ethyl mercaptan and the like.”

Nowhere does this reference disclose or suggest the removal of benzothiophene or dibenzo thiophenes as described by Takashi. Moreover, Satokawa describes that when multiple adsorbents are employed:

“a very burdensome problem will arise, e.g. a plurality of adsorbents corresponding to individual sulfur compounds are undesirably required.” [0009]

The Examiner alleges that it “would have been obvious to one skilled in the art at the time the invention was made to modify Takashi invention and use the transition metal supported zeolite as the desulfurizing agent A as disclosed by Satokawa for an improved desulfurization.” (page 4, lines 16-19)

However, Applicants respectfully submit that modification of Takashi according to Satokawa as suggested by the Examiner would lead to replacement of the Group 17 halogen required by Takashi and therefore render the primary reference unsatisfactory for its intended use to remove benzothiophene or dibenzo thiophenes. The MPEP § 2143.01 refers to *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984) in stating:

“If proposed modification would render the prior art being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification.” (Bold added)

Moreover, Applicants respectfully contend that Satokawa actually teaches away from this combination based on the reference's description quoted above, that multiple adsorbents are undesirable.

Neither Takashi nor Satokawa discloses or suggests the significant improvement in performance achieved according to the method of the claimed invention and demonstrated in Table 1 of the specification. Table 1 is reproduced below for the Examiner's convenience.

Table 1

	Effluent time (h) exceeding 0.07 weight ppm (0.1 vol ppm)			
	COS	DMS	TBM	DMDS
Example 1	6	11	>15	15
Example 2	2	6	14	10
Example 3	3	7	>15	15
Example 4	4	9	>15	11
Example 5	5	10	>15	15
Example 6	5	9	>15	15
Example 7	7	11	>15	15
Example 8	6	11	>15	15
Example 9	7	11	>15	15
Example 10	7	11	>15	15
Example 11	7	11	>15	15
Example 12	3	6	>15	10
Example 13	5	8	>15	14
Comparative Example 1	0	11	>15	9
Comparative Example 2	1	0	>15	3

In Table 1, the values indicate the number of hours a catalyst is active in the removal of Carbonyl Sulfide (COS), dimethyl sulfide (DMS), t-butylmercaptan (TBM) and dimethyl disulfide (DMDS). Examples 1-13 represent the method according to the claimed invention, while Comparative examples 1 and 2, only one of desulphurizing agent A or B was

employed. Applicants respectfully suggest that Comparative Example 1 would be representative of Satokawa.

The data indicates that with respect to COS, the results obtained according to the invention, where the two agents are combined, are significantly improved over what would be expected from the results obtained from either of the individual agents. Thus from 2 to 7 hours of effective catalyst removal of COS is obtained according to the method of the invention in comparison to only one hour expected (1+0) from the comparative examples.

Applicants respectfully submit that neither Takashi nor Satokawa suggest or provide any motivation to expect such improvement.

In view of the foregoing, Applicants respectfully submit that the cited combination of references can neither anticipate nor render obvious the claimed invention. Accordingly, withdrawal of the rejection of Claims 1-4 and 6-15 under 35 U.S.C. 103(a) over Takashi et al. (JP 2001-278602) in view of Satokawa et al. (U.S. 2001/0014304) is respectfully requested.

Applicants respectfully submit that the above-identified application is now in condition for allowance and early notice of such action is earnestly solicited.

Respectfully submitted,

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